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ON THE RECOGNITION OF SEX THROUGH EXTERNAL CHARACTERS IN THE YOUNG RAT.

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The rat is an animal widely used for scientific investigation. Especially through the work on growth by Donaldson and his associates, it has in some respects been more carefully studied than any other animal. The recognition of sex from external characters in the young living rats is therefore sometimes a matter of considerable importance in selecting animals for various lines of investigation.

That considerable inconvenience has been occasioned by difficulty in the early recognition of sex in the living rat is evident. King,¹ for example, states (p. 385) that "The sex of a newborn rat cannot be ascertained with any degree of certainty unless the animal is killed and dissected. When the rats are 14-16 days old, however, the sexes are easily distinguished as Dr. Stotsenberg has discovered, since the mammæ are clearly visible at this time. After this period the hair covers the entire body and it becomes very difficult to distinguish the sexes in the living young until they are several weeks old." Slonaker² similarly notes (p. 4) that "Owing to the fact that it is difficult to determine the sex of the young rats with accuracy the sexes were not distributed as I would have wished."

Since no method of distinguishing the sexes in the young rat (except that noted by King) has, so far as I know, been published, the following observations, which were made during a study of growth in the white rat, may be of some interest and value. While the observations were made exclusively upon the white or albino rat (*Mus norvegicus albinus*), they will doubtless apply

¹ Helen Dean King, "The Effects of Semi-Spaying and of Semi-Castration on the Sex Ratio of the Albino Rat (*Mus Norvegicus albinus*).¹" *Journal of Experimental Zoölogy*, Vol. 10, No. 4, 1911.

² James Rollin Slonaker, "The Effect of a Strictly Vegetable Diet on the Spontaneous Activity, the Rate of Growth, and the Longevity of the Albino Rat." Leland Stanford Junior University Publications. University Series, April 2, 1912.

also to the ordinary gray or brown rat (*Mus norvegicus*). A few observations upon young gray mice indicate that (at least with respect to the ano-genital distance and the size of the genital papilla) the same method may be utilized in distinguishing the sexes in this and perhaps other members of the genus.

TABLE I.

ANO-GENITAL DISTANCE IN YOUNG ALBINO RATS OF VARIOUS AGES.

Age.	Number of Each Sex.		Average Gross Body Weight (and Range).		Average Ano-genital Distance (and Range).	
	Male.	Female.	Male, Grams.	Female, Grams.	Male, Mm.	Female, Mm.
Newborn.	10	12	5.7 (5.1-6.3)	5.4 (4.7-6.3)	2.8 (2.5-3.0)	1.2 (1.0-1.5)
7 days ..	17	26	11.0 (8.8-12.9)	10.4 (6.7-12.2)	5.2 (4.5-6.0)	2.7 (2.0-3.5)
14 days ..	13	15	19.5 (17.0-21.9)	18.2 (15.3-19.9)	8.2 (7.0-9.0)	4.9 (4.0-6.0)
20 days ..	19	26	27.4 (15.6-40.0)	27.4 (19.7-41.6)	12 (10-14)	7 (6-9)
6-7 weeks	19	13	73.3 (57-114)	71 (23.5-95)	21 (17-25)	13 (9-15)

The observations may be grouped under four headings. The first and most important character to be noted is the *ano-genital distance*, which is the distance measured from the anal aperture to the base of the genital papilla (clitoris or penis). The measurements are summarized in Table I. They were made on the living animals at the various ages from birth to 6 or 7 weeks, when the sexes are easily distinguished by the ordinary characters. It will be observed that *in all cases the ano-genital distance in the male is much greater than in the female of the same age*. It averages nearly twice as great. Although, owing to the great range of variation in the size of the body, the largest distance recorded in the table for the female sometimes approaches the smallest found in the male for the same age, there is never *in any given litter* the slightest difficulty by this measurement in determining the sex with ease and accuracy.

A second characteristic is found in the *size of the genital papilla*. This (anlage of penis or clitoris) is always larger and more prominent in the male than in the female. This difference is clearly evident when the sexes are compared in individuals of the same litter.

A third characteristic is the *presence of the mammæ*, already mentioned by King as observed by Stotsenberg. I have con-

firmed the statement that the mammæ (nipples) are readily visible in the female of 14-15 days, and that after that time they become hidden by the hair. During lactation, of course, they again appear. I have also observed further that the nipples are visible at an earlier age than that mentioned. During the entire second week, and at least in some cases during the first week, they can be noted by careful observation in the female. From the time they first appear, the definite number (six pairs) is present.

When the hair coat becomes well developed, at about 16 or 17 days of age (when also the eyes are opened), a fourth sexual characteristic may be noted. In the male, a small area just ventral to the anus remains bare. In later stages it becomes to a certain extent covered with short hairs, but always remains relatively bare. This corresponds to the dorsal part of the scrotal area, as may be noted after the sixth week, when the testes occasionally descend. In the female, there is a corresponding bare, or relatively bare, strip which extends all the way from the anus to the genital papilla (clitoris). The part of this bare strip just dorsal to the clitoris corresponds to the vaginal aperture; but the aperture does not appear until the middle or end of the second month. In one case, a female bore a litter at the age of 10 weeks, and must therefore have become pregnant at about 7 weeks. Lantz¹ cites a case where a white rat is said to have given birth to 11 young when only 8 weeks old, and which therefore must have bred when only 5 weeks old.

It is evident from the foregoing that of the four characteristics noted for distinguishing the sexes in young rats, one (visibility of nipples) applies only before the age of about 16 days; one (bare areas in ano-genital region) applies only after that age; while the other two (ano-genital distance and size of genital papilla) apply to all ages.

¹ David E. Lantz, *Natural History of the Rat*. In "The Rat and its Relation to the Public Health," by various authors. P. H. and M. H. Service, Washington, 1910.